SEARCH FOR NEW PHYSICS IN THE EXCLUSIVE $\gamma_{DELAYED}$ + MISSING TRANSVERSE ENERGY CHANNEL IN $P\bar{P}$ COLLISIONS AT $\sqrt{S} = 1.96$ TEV

A Thesis

by

JONATHAN ABRAHAM ASAADI

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

December 2012

Major Subject: Physics

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Approved by:

Chair of Committee,	David Toback
Committee Members,	Guy Almes
	Bhaskar Dutta
	Ricardo Eusebi
Head of Department,	George Welch

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ABSTRACT

Search for New Physics in the Exclusive $\gamma_{Delayed}$ + Missing Transverse Energy Channel in $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV. (December 2012)

Jonathan Abraham Asaadi, B.S, University of Iowa; M.S., Texas A&M University

This dissertation presents the results of a search in the exclusive photon plus missing transverse energy (γ+ $\not\!\!E_T$) final state in proton antiproton collisions at a center of mass energy of 1.96 TeV using the Collider Detector at Fermilab experiment. The strategy used here is to search for delayed photons coming from gauge mediated supersymmetric events with the exclusive production of $\tilde{\chi}_1^0 \rightarrow \gamma\tilde{G}$. In these models the $\tilde{\chi}_1^0$ is the lightest neutralino and has nanosecond lifetime before decaying to a photon (γ) and gravitino ($\tilde{G}$) which exits the detector unrecorded. In order to search for this process we select collisions that have a single photon plus missing transverse energy and little other activity in the detector and examine the arrival time of the photon. This arrival time is then compared against expectations from a data driven background of the standard model sources. In the data collected from the Fermilab Tevatron collider from December 2004 to June 2010, representing 6.3 fb^{-1} of data, we observe 322 events in the photon arrival timing region from 2 nanoseconds to 7 nanoseconds with a data driven background prediction of 257 $\pm$ 35. An excess of 65 events is observed, equivalent to a standard deviation (N_σ) of 1.65 from the null hypothesis.

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